

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1 (Currently amended): A method of measuring efflux of a chemical from a cell, or a population of cells, the method including introducing the chemical to the cell and measuring an electrochemical property of a medium surrounding the cell with an electrochemical system which includes a working electrode and a reference electrode, the property being related to a concentration of the chemical in the medium, the method characterized by:

adding oxygen to the medium to increase a signal strength of the electrochemical property, the step of adding oxygen to the medium including bubbling an oxygen-containing gas into the medium.

Claim 2 (Original): The method of claim 1, further characterized by:
preconcentrating the chemical in the medium on the working electrode prior to the step of monitoring the electrochemical property of the medium.

Claim 3: (Previously presented): The method of claim 1, further characterized by:
the cell population comprising a monolayer of cells.

Claim 4 (Previously presented): The method of claim 1, further characterized by:

the cell being a single cell.

Claim 5 (Canceled)

Claim 6 (Currently amended): The method of claim ~~5~~ 1, further characterized by:

the step of bubbling an oxygen-containing gas into the medium including bubbling a gas having a greater oxygen concentration than ambient air into the medium.

Claim 7 (Currently amended): The method of claim 1, further characterized by:

prior to the step of measuring an electrochemical property of the medium, positioning the cell or population of cells on a substrate, a surface of the substrate having at least one hydrophilic region to which at the cell or the population of cells attaches, the hydrophilic region being surrounded by a hydrophobic region which resists attachment of cells to the surface.

Claim 8 (Original): The method of claim 7, further characterized by:
the hydrophilic region being sized to permit attachment of only one cell.

Claim 9 (Previously presented): The method of claim 7, further characterized by:

the substrate including a number of spatially orientated hydrophilic regions for spatially orienting a preselected number of cells or groups of cells..

Claim 10 (Previously presented): The method of claims 7, further characterized by:

the working electrode being a carbon ring electrode, formed on the surface of the substrate.

Claim 11 (Previously presented): The method of claim 7, further characterized by:

the step of introducing the chemical to the cell including injecting the chemical into the cell.

Claims 12 (Previously presented): The method of claim 11, further characterized by:

the step of injecting the chemical into the cell including forming an aperture in the substrate and allowing the chemical to diffuse into the cell from an injection tube of a diffusional microburette.

Claim 13 (Previously presented): The method of claim 1, further characterized by:

the chemical being a drug used for the treatment of cancer.

Claim 14 (Previously presented): The method of claim 1, further characterized by:

the step of measuring an electrochemical property including voltammetric scanning in the region of a cathodic peak of the chemical.

Claim 15 (Original): The method of claim 1, wherein the step of measuring the electrochemical property includes:

- (a) preconcentrating effluxed chemical on the working electrode;
 - (b) detecting a function of the current flowing between the working electrode and a second electrode;
 - (c) cleaning the electrode to remove traces of the chemical from the working electrode;
 - (d) comparing the function obtained in step (b) with a calibration curve to obtain a measure of a concentration of the chemical in the medium; and
- repeating steps (a) - (d) to obtain a plot of concentration over time.

Claim 16 (Currently amended): An apparatus for measuring efflux of a chemical from a biological cell, or a population of cells, the apparatus including:

- a substrate having a surface which receives the cell;
- a medium on the substrate;

an electrochemical monitoring system which measures an electrochemical property of the medium surrounding the cell, the property being related to a concentration of the chemical in the medium, the apparatus characterized by:

the substrate surface having at least one attachment region to which the cell or population of cells attaches, the region being surrounded by a resistant region which resists the attachment of cells;

the electrochemical system including a carbon electrode which extends at an angle relative to the at least one attachment region for measuring the electrochemical property of the medium surrounding the cell.

Claim 17 (Previously presented): The apparatus of claim 16, further characterized by:

a source of an oxygen containing gas which supplies oxygen to the medium for increasing the signal strength of the electrochemical property.

Claim 18 (Original): The apparatus of claim 17, further characterized by:
the source of the oxygen containing gas comprising a container of substantially pure oxygen under pressure.

Claim 19 (Currently amended): The apparatus of claim 16, further characterized by:

the ~~electrochemical system including a carbon electrode which is being~~ positioned adjacent the at least one attachment region for measuring the electrochemical property of the medium surrounding the cell.

Claim 20 (Previously presented): The apparatus of claim 19, further characterized by the carbon electrode defining an annulus which surrounds the at least one attachment region.

Claim 21 (Currently amended): The apparatus of claim 16, further characterized by:

the hydrophilic attachment region being sized for attachment of only one cell.

Claim 22 (Previously presented): The apparatus of claim 16, further characterized by:

the substrate including a number of spatially orientated hydrophilic regions for spatially orienting a preselected number of cells or groups of cells.

Claim 23 (Previously presented): The apparatus of claim 16, further characterized by:

a sensor formed on the surface of the substrate adjacent the at least one attachment region for detecting at least one of pH, oxygen, and calcium concentration of the medium.

Claim 24 (Previously presented): The apparatus of claim 16, wherein the surface includes a plurality of attachment regions which each attracts a single cell or a group of cells, each attachment region having an associated working electrode positioned adjacent the attachment region.

Claim 25 (Previously presented): The apparatus of claim 16, further including a retaining wall, formed on the substrate, for retaining the medium around the cell or cells.

Claim 26 (Previously presented): The apparatus of claim 16, further characterized by the substrate comprising a mesh, the medium disposed above and below the mesh.

Claim 27 (Currently amended): A method of measuring efflux of a chemical from a biological cell, or a population of cells, the method including introducing the chemical to the cell and measuring a an electrochemical property of a medium surrounding the cell or population of cells, the property being related to a concentration of the chemical in the medium, the method characterized by:

positioning the cell or population of cells on a surface of a substrate by attachment of the cell or the cell population to a an attractive region of the substrate which permits attachment, the attractive region of the substrate being surrounded by a region which resists attachment of cells;

the electrochemical system including a carbon electrode which extends at an angle relative to the at least one attachment region for measuring the electrochemical property of the medium surrounding the cell.

Claim 28 (Original): The method of claim 27, further characterized by:

the property being an electrochemical property and the step of measuring the property including employing a working electrode including a carbon ring electrode formed on the substrate adjacent the attractive region of the substrate.

Claim 29 (Currently amended): A method of measuring transport of a chemical across a membrane of a human or other biological cell, the method comprising exposing the cell to the chemical and measuring a an electrochemical property of a liquid medium disposed outside the cell, the property being related to a concentration of the chemical in the medium, the method characterized by:

providing a substrate surface with a region formed from a material to which the cell attaches, the region being surrounded by a portion of the surface which resists attachment of a cell;

patterning the substrate using photolithographic techniques to define at least one sensor adjacent the attachment region for sensing the property of the liquid medium;

depositing the cell on the region; and

after the step of exposing the cell to the chemical, detecting the property of the liquid medium surrounding the cell and determining the concentration of the chemical in the medium therefrom;

the electrochemical system including a carbon electrode which extends at an angle relative to the at least one attachment region for measuring the electrochemical property of the medium surrounding the cell.

Claim 30 (Currently amended): A method of measuring transport of a chemical across a membrane of a biological cell, the method comprising exposing the cell to the chemical, the method characterized by:

providing a substrate surface with a site formed from a material to which the cell attaches, the site being surrounded by a portion of the surface which resists attachment of a cell;

depositing the cell on the site;

moving a sensor through a wall of the cell to contact the material in the cell;
and

measuring a property of a material within the cell with the sensor, the property being related to a concentration of the chemical in the cell and determining the concentration of the chemical in the cell therefrom.

Claim 31 (New): An apparatus for measuring efflux of a chemical from a biological cell, or a population of cells, the apparatus including:

a substrate having a surface which receives the cell; a medium on the substrate;

an electrochemical monitoring system which measures an electrochemical property of the medium surrounding the cell, the property being related to a concentration of the chemical in the medium, the apparatus characterized by:

the substrate surface having at least one attachment region to which the cell or population of cells attaches, the region being surrounded by a resistant region which resists the attachment of cells;

the electrochemical system including a carbon electrode defining an annulus which surrounds the at least one attachment region.